Public Perception of Winter Weather Warnings; December 2007 – January 2010

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The Post Storm Survey

- On March 1 2007, Duluth, MN was impacted by significant blizzard.

Significant meaning:

- 23 inches of snow
- 50 knot winds
- 10-15 foot snow drifts
- No emergency services/post office service
- Downtown closed

March 1 2007 Blizzard

- Blizzard watch/warning issued 36/24 hours in advance
- Warning text:

  “THIS STORM WILL LIKELY PARALYZE TRAVEL DUE TO HEAVY SNOW AND BLOWING SNOW...AS WELL AS BLIZZARD CONDITIONS NEAR LAKE SUPERIOR. A STORM OF THIS MAGNITUDE HAS THE POTENTIAL TO CAUSE VERY DANGEROUS OR IMPOSSIBLE DRIVING CONDITIONS. PLAN ACCORDINGLY.”

March 1 2007 Blizzard

- Despite clear advanced warning, people still caught off guard.
- Highlighted need for improved warning communication, so people know the hazards that coming weather will cause.
- To achieve this, a survey was developed through Duluth forecast office.

Post Storm Survey (PSS)

Motivation

"Need a process by which WFO [Weather Forecast Offices] can systematically gather local customer input and local research results … and turn that information into improved products and services"

Ray Wolf – Science and Operations Officer NWS WFO Davenport, IA

Goal

Improve communication & effectiveness of winter weather information and threat by gaining insight into perceptions and decision making processes related to hazardous winter weather.

Warning Communication

URGENT - WINTER WEATHER MESSAGE...UPDATED
NATIONAL WEATHER SERVICE DULUTH MN
213 PM CST WED DEC 23 2009

...BLIZZARD WARNING IN EFFECT FROM 6 AM THURSDAY TO 6 AM CST SATURDAY...

THE NATIONAL WEATHER SERVICE IN DULUTH HAS UPGRADED THE WINTER STORM WARNING TO A BLIZZARD WARNING FOR AREAS AROUND THE SOUTHWEST SHORES OF LAKE SUPERIOR. THE BLIZZARD WARNING IS IN EFFECT FROM 6 AM THURSDAY TO 6 AM CST SATURDAY..

***STORM TOTAL SNOW ACCUMULATIONS OF 14 TO 18 INCHES APPEAR LIKELY... WITH SOME LOCAL AMOUNTS GREATER THAN 20 INCHES POSSIBLE...ESPECIALLY FROM DULUTH NORTHEASTWARD ALONG THE HIGHER TERRAIN OF THE NORTH SHORE OF LAKE SUPERIOR.**
***EAST TO NORTHEAST WINDS WILL CONTINUE TO SLOWLY INCREASE FROM 15 TO 30 MPH TONIGHT... TO 20 TO 40 MPH BY TOMORROW EVENING INTO CHRISTMAS MORNING. SOME LOCALLY HIGHER GUSTS ARE LIKELY IN AREAS ADJACENT TO LAKE SUPERIOR. THE COMBINATION OF WINDS AND HEAVY FALLING SNOW WILL RESULT IN WIDESPREAD BLOWING AND DRIFTING SNOW AND WHITE OUT CONDITIONS AT TIMES.**
***ROAD CONDITIONS WILL DETERIORATE RAPIDLY DURING THE DAY TOMORROW WITH ANY TRAVEL BECOMING DANGEROUS BY LATE TOMORROW AFTERNOON AND LASTING THROUGH MUCH OF CHRISTMAS.**
*** THE MOST SEVERE CONDITIONS ARE EXPECTED FROM LATE TOMORROW AFTERNOON... THROUGH CHRISTMAS EVE AND MUCH OF THE DAY ON CHRISTMAS WHEN THE COMBINATION OF 1 TO 2 INCH PER HOUR SNOWFALL ACCUMULATION RATES AND VERY STRONG WINDS WILL CREATE WHITEOUT CONDITIONS.**

Major Problems

Paper Reduction Act

- Prohibits government from directly soliciting customer input, without prior approval. This would greatly complicate the survey.
- Decided to pass survey on to SCSU through Matt Taraldsen.

Building the Survey

- Survey questions started early summer 2007 at NWS weather forecast office (WFO) Duluth.
- Goal to build an online survey that partners could “link” to.
- Needed to be “.edu” for NWS involvement, utilized student workspace.

Building the Survey

- Built a website through SCSU student webspace.
- Approved by advisors; then worked with SCSU statistics dept. to build survey.
- Survey and site were then approved by NWS Central Region and Eastern Region Headquarters for use on websites.

Building the Survey

- Criteria was for “warning” events only, to capture truly disruptive events.
- Survey was active 72 hours following the end of the warning.
- Used “Survey Monkey” to store and analyze results.
- Data would be available to all partners.

Previous Research

- Winter storm communication not widely researched.
- Nearly all papers were for summertime warnings.
- One paper that did create good starting point: *Quick Response Survey*, Drobot (July 2007).

Previous Research

- Used Drobot's paper as base.
- However, wanted this project to be larger and longer lasting.
- Used Drobot to design some questions.
- Further question refinement would also use Doswell (2008), Zhang (2008), and *The Subcommittee on Disaster Reduction Report* (2008).

Building Questions

- Used some questions straight from Drobot, others original to survey.
- It quickly became apparent that experts were needed:
  Dr. Anthony Hansen (EAS Dept.)
  Prof. Suzanne Stangl-Erkens (CMST Dept.)
- Questions finished in December 2007.

Raising Visibility

- Needed to wait until March for first winter weather event.
- Decided to try and get media, other government agencies, and other NWS forecast offices.
- Didn't go so well, only three partners in for the test season 2007.

Raising Visibility

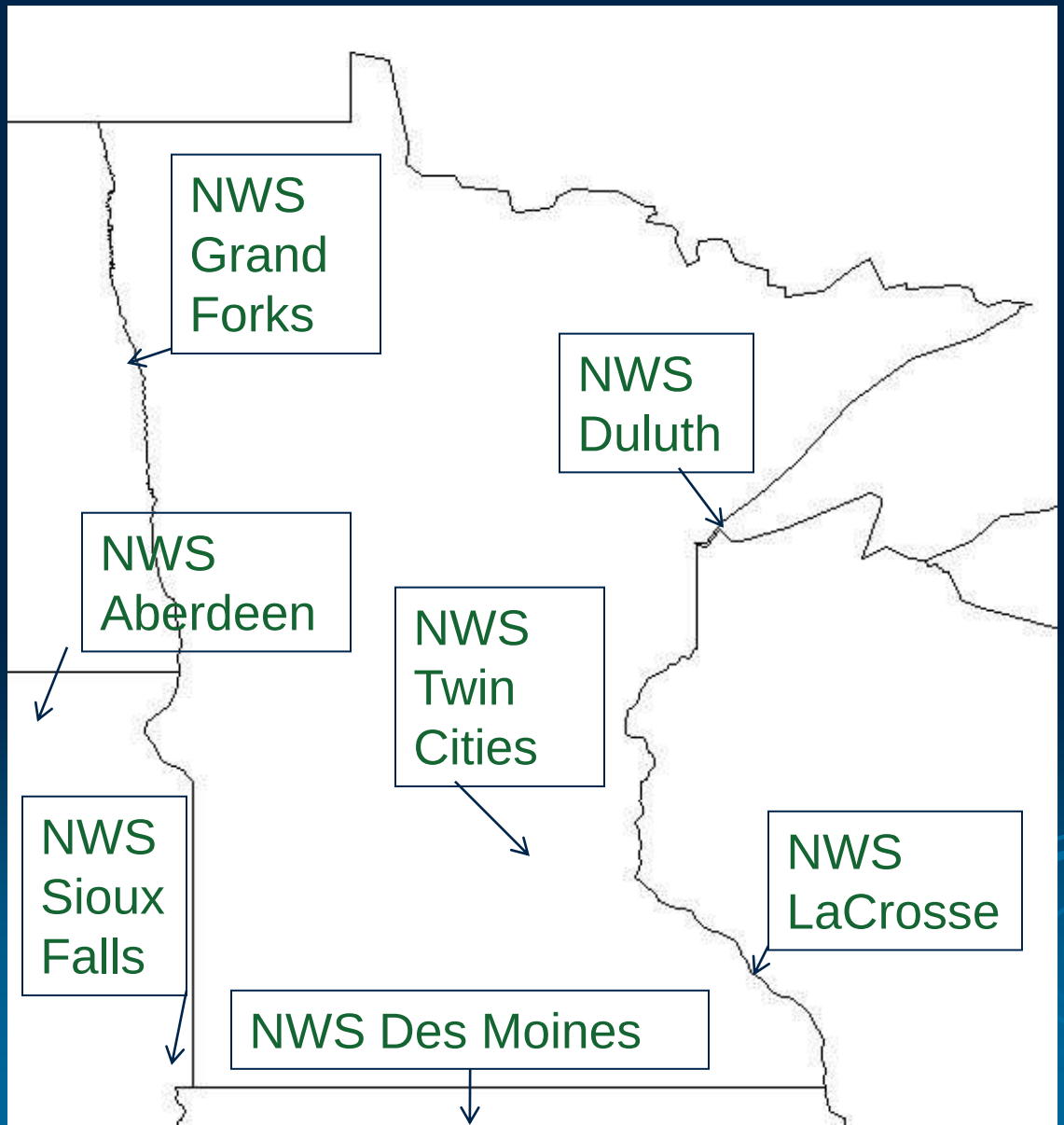
- Decided to use test season as a way to gain visibility for the next season.
- Ended up with 506 responses.
- Next step was to begin presenting data to reach more partners.

Presenting Results

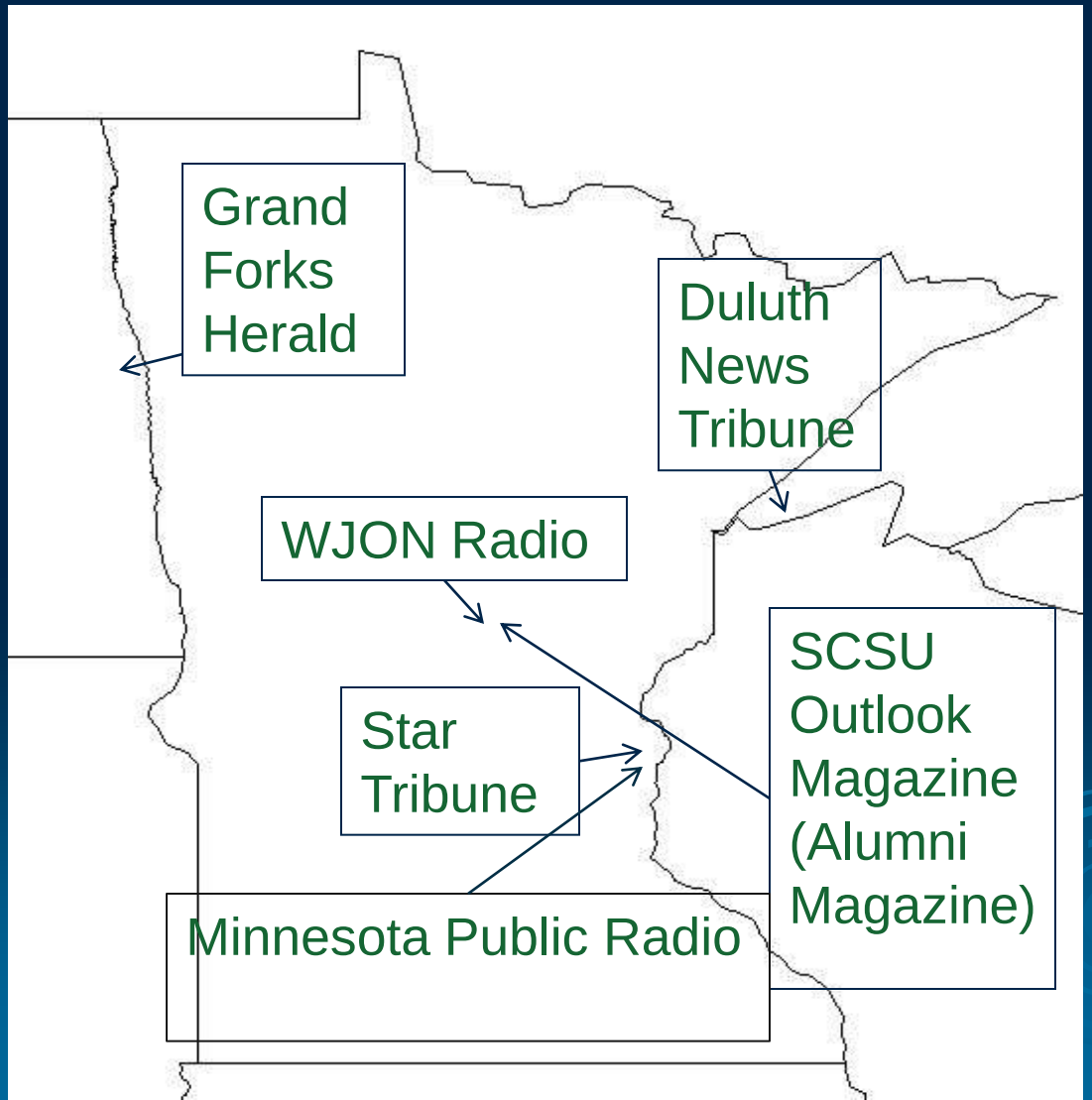
- Partners and Faculty at SCSU
- 2008 Northern Plains Winter Storm Conference
- 2009 Student Research Colloquium
- 2009 Winchell Undergraduate Symposium
- 2009 Northern Plains Winter Storms Conference
- 2010 Student Research Colloquium (intended)
- Also did over a dozen media interviews.

2007/2008 Partners

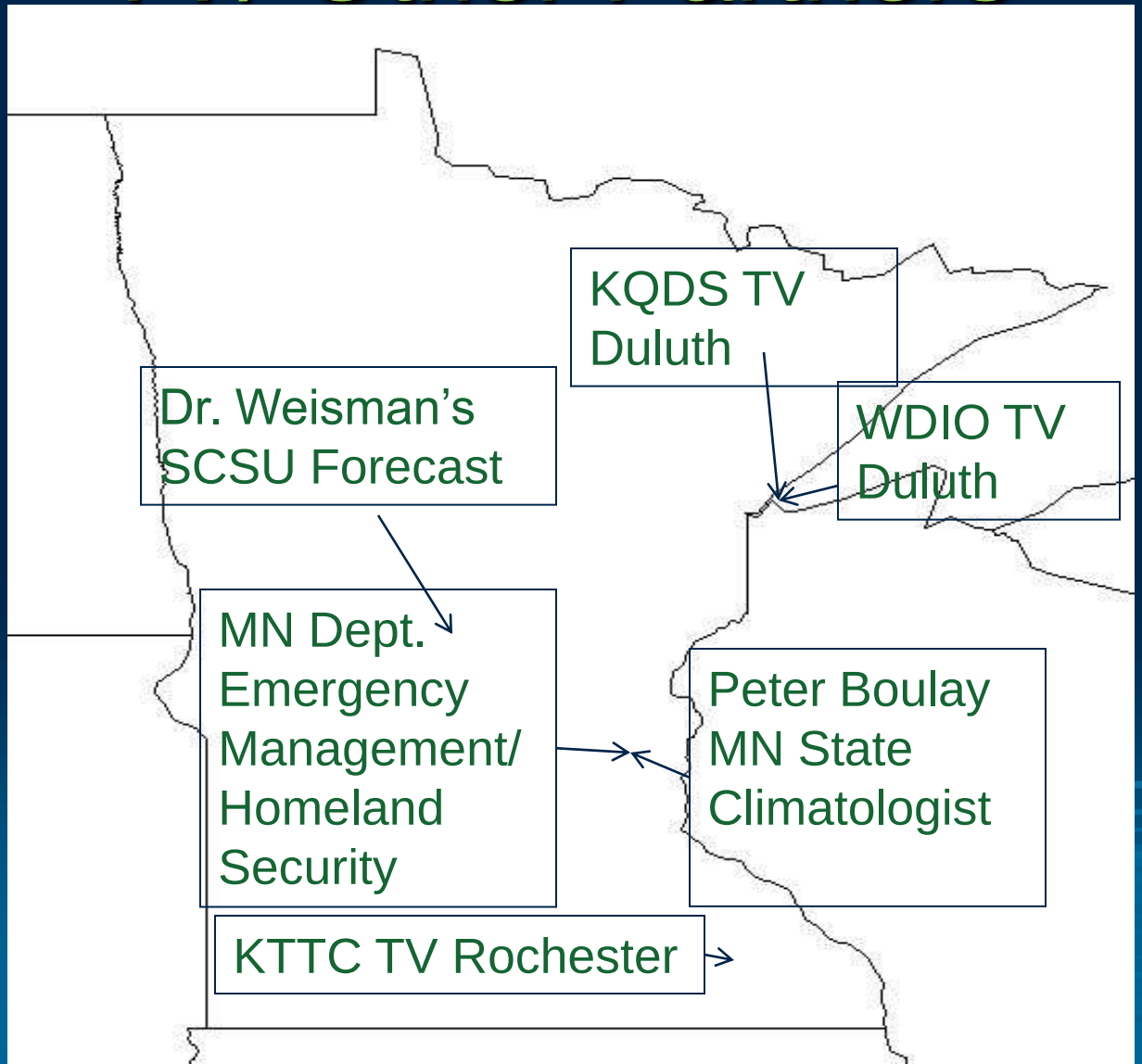
2008/2009 NWS Partners



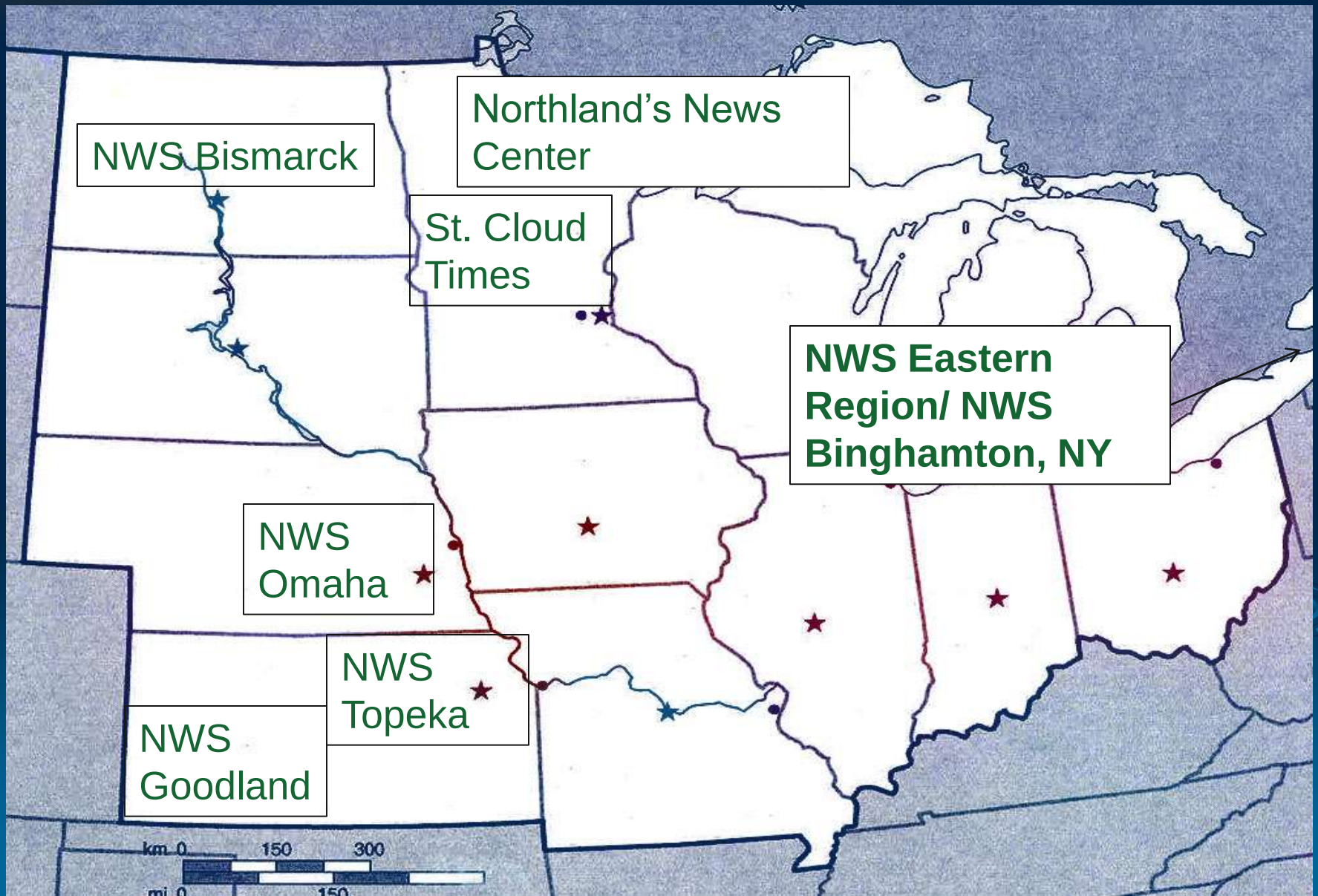
2008/2009 Newspaper/Radio Partners



2008/2009 TV/ Other Partners



New 2009/2010 Partners



Social Networking…

- In addition to traditional modes of communication, also used Facebook and Twitter for dissemination.
- Seemed to worked well in communicating with partners, as well as gaining visibility with people taking the survey.
- Featured in NWS *Peak Performance* Spring 2009.

PSS Events

Date	Warning	Issuing Office(s)
April 10 2008	Blizzard	DLH
April 6 2008	Winter Storm	DLH
March 16 2008	Winter Weather*	DLH (test event, advisory only)

PSS Events

Date	Warning	Issuing Office(s)
Dec 12 2008	Blizzard	DLH, FGF
Dec 18 2008	Ice Storm	DMX
Dec 19 2008	Lake Effect Snow	DLH
Dec 20 2008	Blizzard	MPX, ABR, FSD, DMX
Dec 20 2008	Winter Storm	FGF, ARX, DLH, MPX
Dec 30 2008	Winter Storm	FGF, DLH, MPX
Jan 3 2009	Winter Storm	DLH, MPX, FGF
Jan 12 2009	Blizzard	FGF, FSD, DMX
Jan 12 2009	Winter Storm	MPX
Jan 12 2009	Wind Chill	DLH
Feb 8 2009	Ice Storm	DLH
April 5 2009	Blizzard	DMX

PSS Events

Date	Warning	Issuing Office(s)
Dec 8 2009	Blizzard	ARX, DMX, MPX, OMA, TOP, FSD
Dec 8 2009	Winter Storm	ABR, DLH
Dec 24 2009	Blizzard	DLH, OMA, TOP
Dec 24 2009	Winter Storm	ARX, MPX, FGF, DLH
Dec 25 2009	Blizzard	FGF, FSD, ABR
Jan 7 2010	Winter Storm	MPX
Jan 21 2010	Ice Storm	DMX, FSD**
Jan 25 2010	Winter Storm	DLH, FGF**
Jan 25 2010	Blizzard	DMX, FGF, MPX, FSD, ABR**
Feb 9 2010	Winter Storm	MPX, ARX, DMX, FSD, ABR, FGF**
Feb 9 2010	Lake Effect Snow	DLH**
Feb 11 2010	Winter Storm	BGM**

PSS Events

- 2007: 3 Events, 500 Responses
- 2008: 12 Events, 2500 Responses
- 2009: 12 Events, 3100 Responses*

Project Total: 27 Events, Over 6000 Responses

The Post Storm Survey Final Results

Demographic Information

Occupation	2008	2009	2010	Average
Retired	6%	6%	8%	6.7%
Student	11%	4%	2%	5.7%
Unemployed	3%	5%	4%	4.0%
Industrial	5%	10%	13%	9.3%
Self-Employed	3%	1%	2%	2.0%
Professional	35%	40%	42%	39.0%
Public Service	9%	9%	8%	8.7%
Teacher	25%	23%	21%	23.0%
Scientist	3%	3%	2%	2.7%

Demographic Information

Age

	2008	2009	2010	Average	2000 Census
<16	2%	1%	1%	1.3%	21.40%
16 - 22	11%	8%	7%	8.7%	13.90%
23-39	29%	38%	38%	35.0%	20.90%
40 - 59	51%	46%	46%	47.7%	34.20%
>60	8%	8%	9%	8.3%	9.60%

Highest Education Level

	2008	2009	2010	Average	2000 Census
Some High School	2%	2%	3%	2.3%	12.10%
High School Diploma	8%	9%	8%	8.3%	28.60%
Some College	25%	27%	27%	26.3%	21.10%
College Degree	43%	42%	42%	42.3%	21.80%
Advanced Degree	21%	20%	20%	20.3%	8.90%

Demographic Information

Gender

	2008	2009	2010	Average	2000 Census
Male	69%	68%	69%	68.7%	49.10%
Female	31%	32%	31%	31.3%	50.90%

Average Commute

	2008	2009	2010	Average	2000 Census
1 -15 min	55%	52%	55%	54.0%	N/A
15 - 30 min	33%	32%	33%	32.7%	N/A
31 - 59 min	10%	14%	10%	11.3%	N/A
60+ min	3%	3%	3%	3.0%	N/A

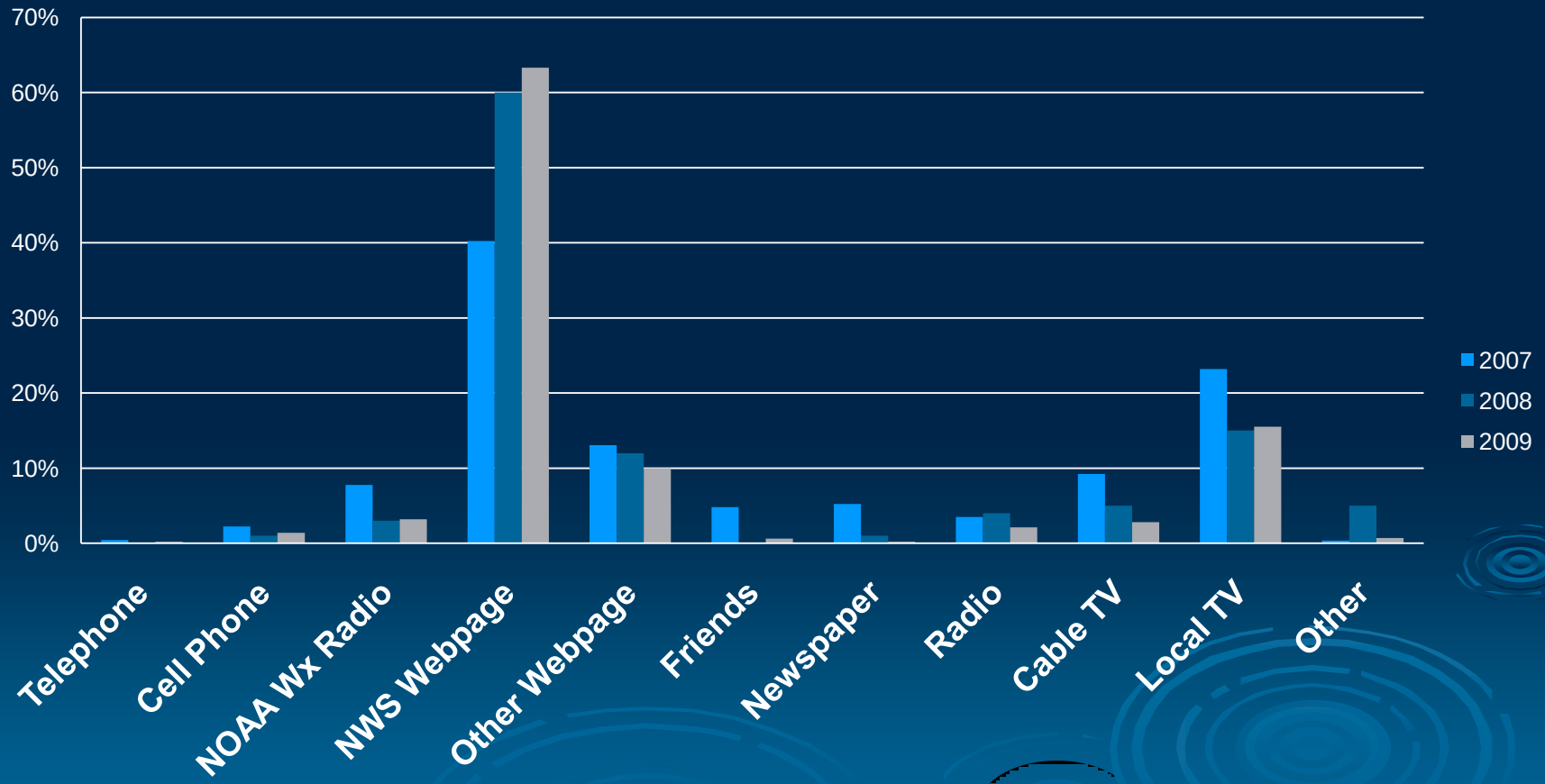
Are you a weather spotter?

	2008	2009	2010	Average	2000 Census
Yes	24%	22%	28%	24.7%	N/A
No	76%	78%	72%	75.3%	N/A

All Responses

** Combined responses from all events**

1. Where do you get weather information on <u>a regular basis</u>?
(Select the one that most applies).

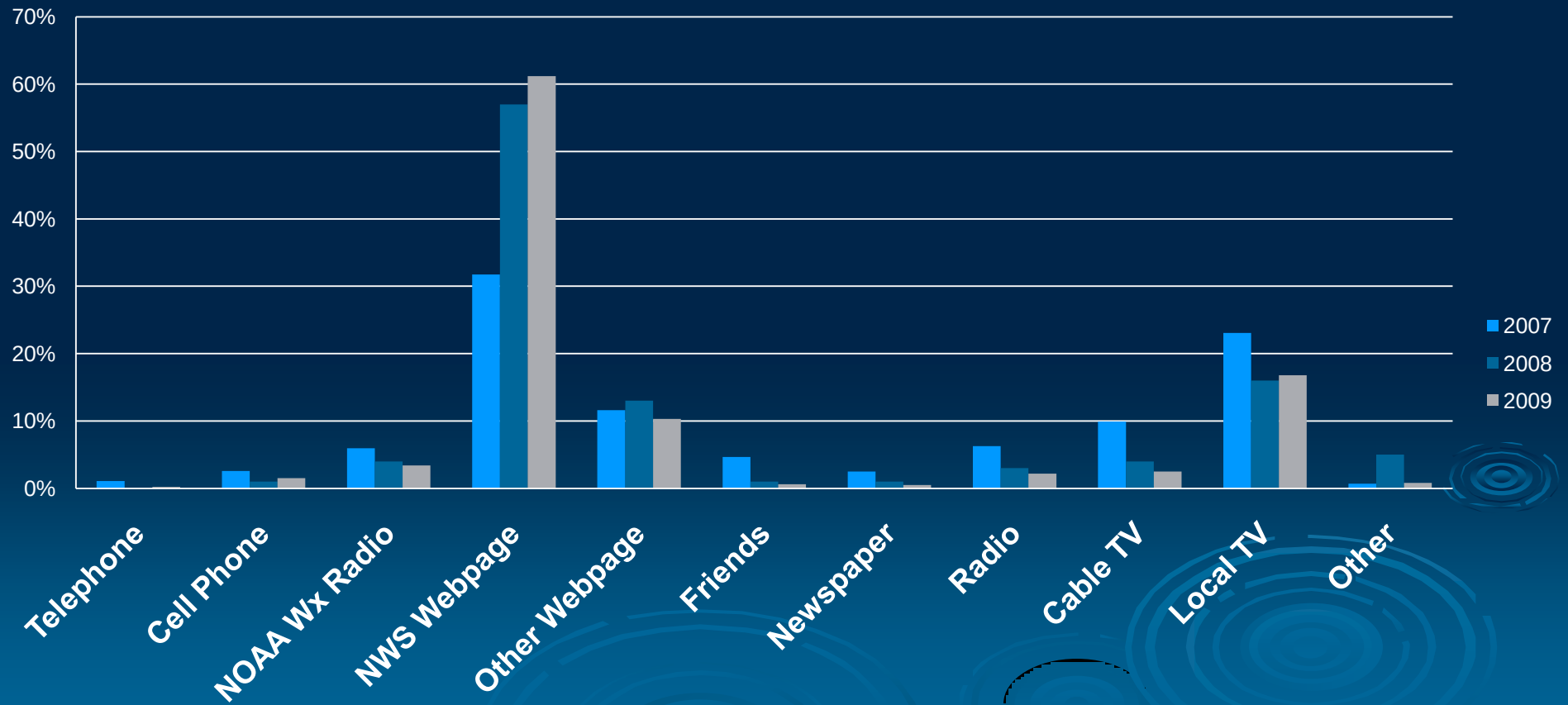


All Responses

** Combined responses from all events**

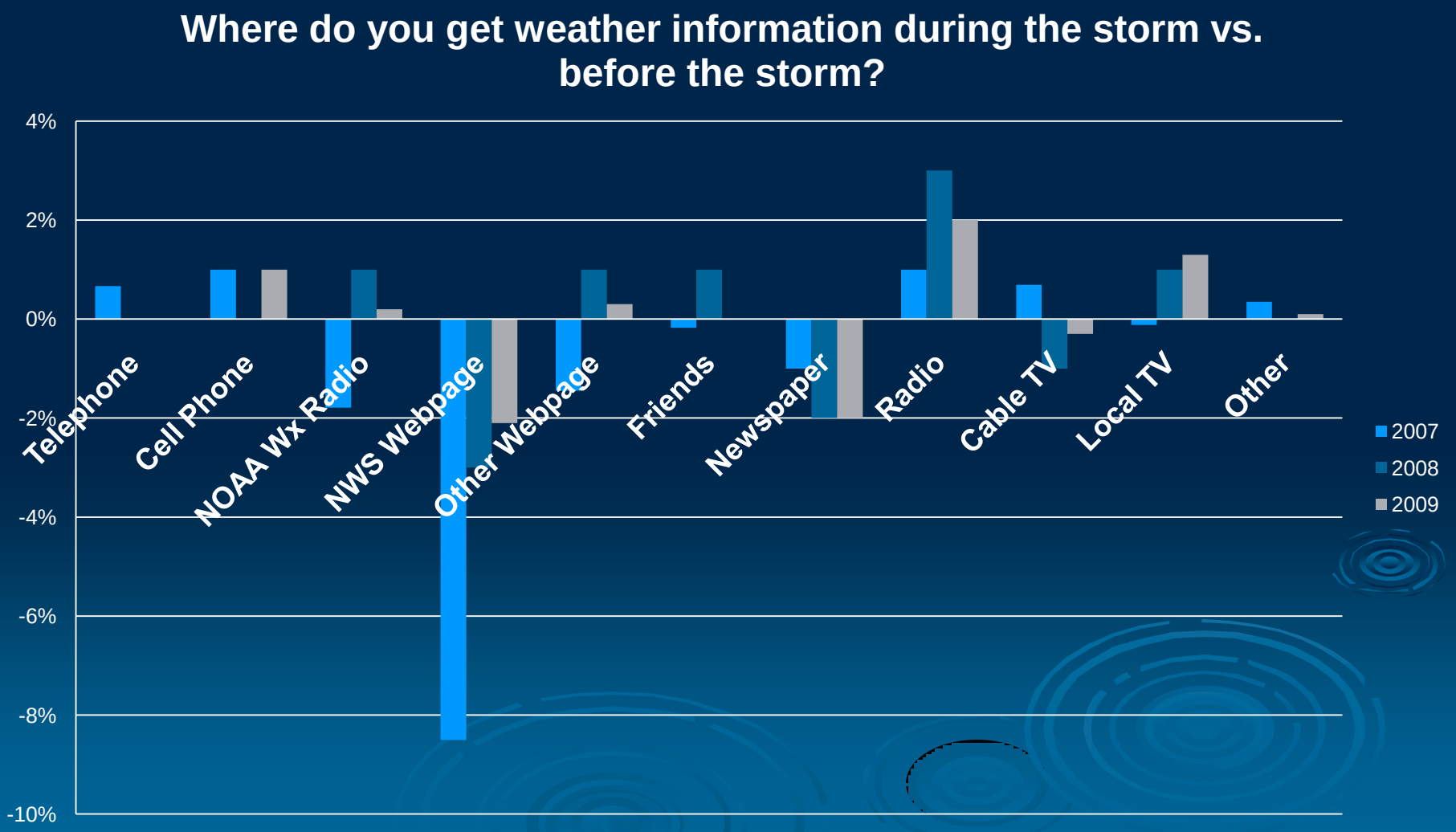
2. Where do you get weather information during the storm?

(Select the one that most applies).



All Responses

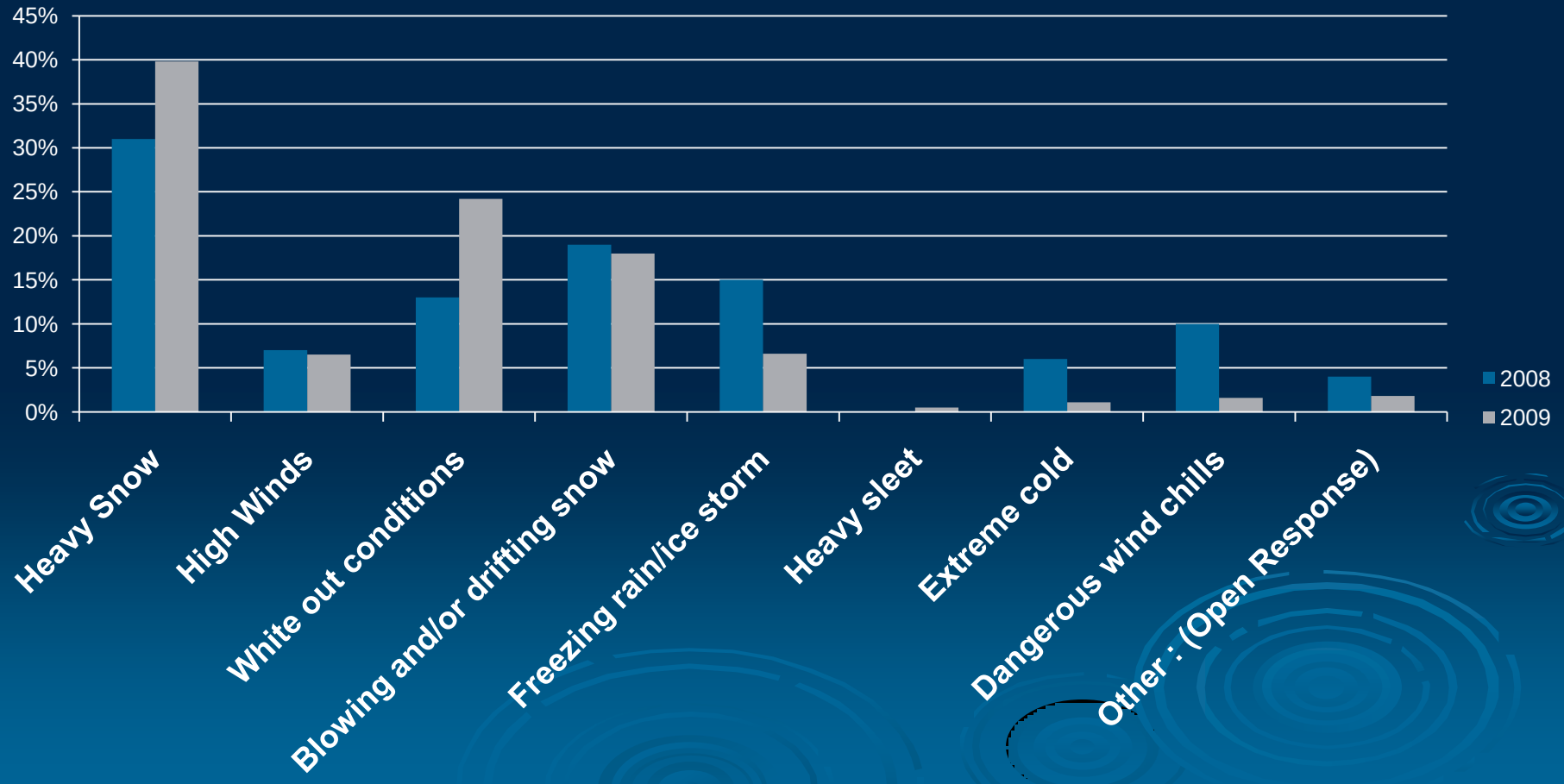
** Combined responses from all events**



All Responses

** Revised 2009 Question**

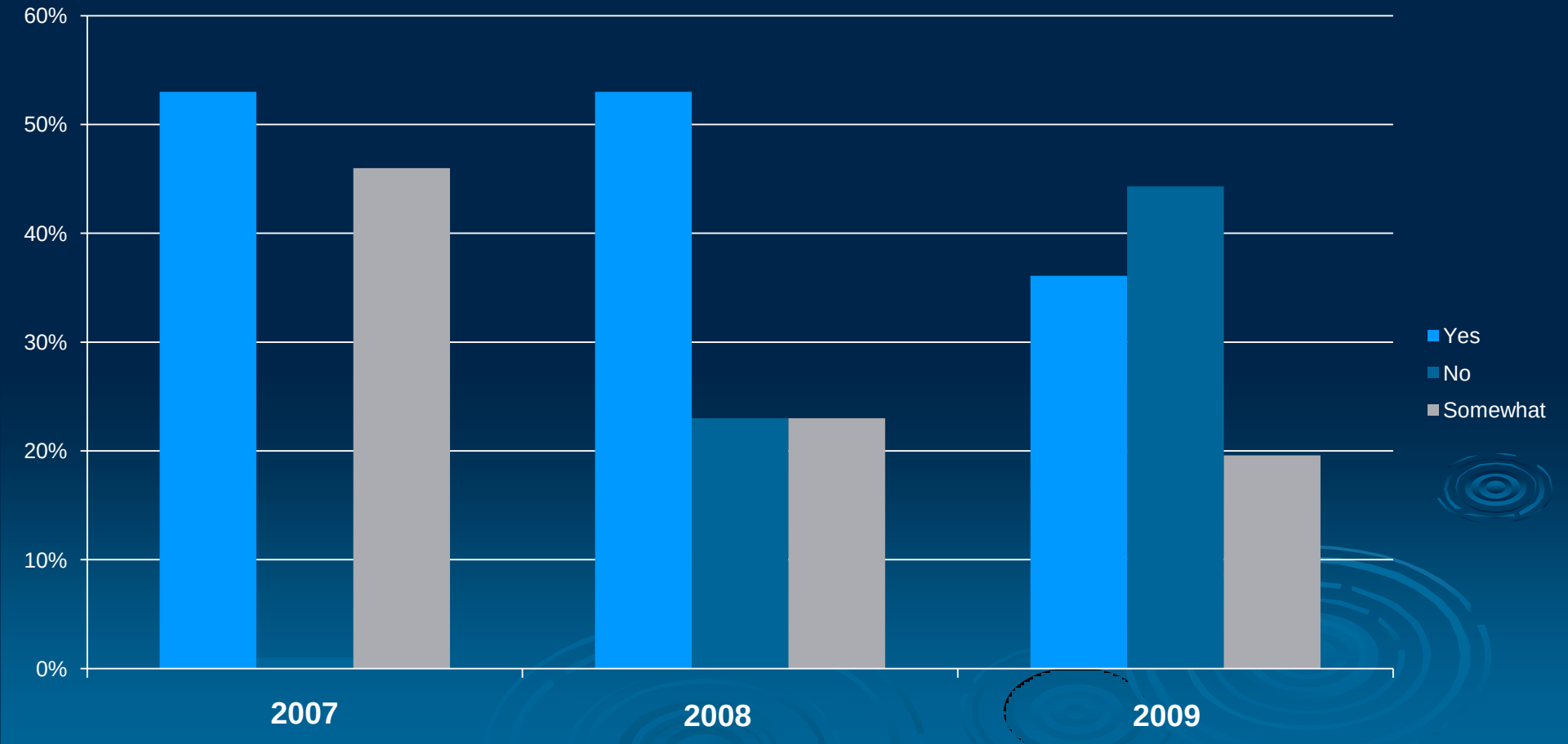
3) Based on the forecast, what did you feel was the primary weather threat from the storm?



All Responses

** Combined responses from all events**

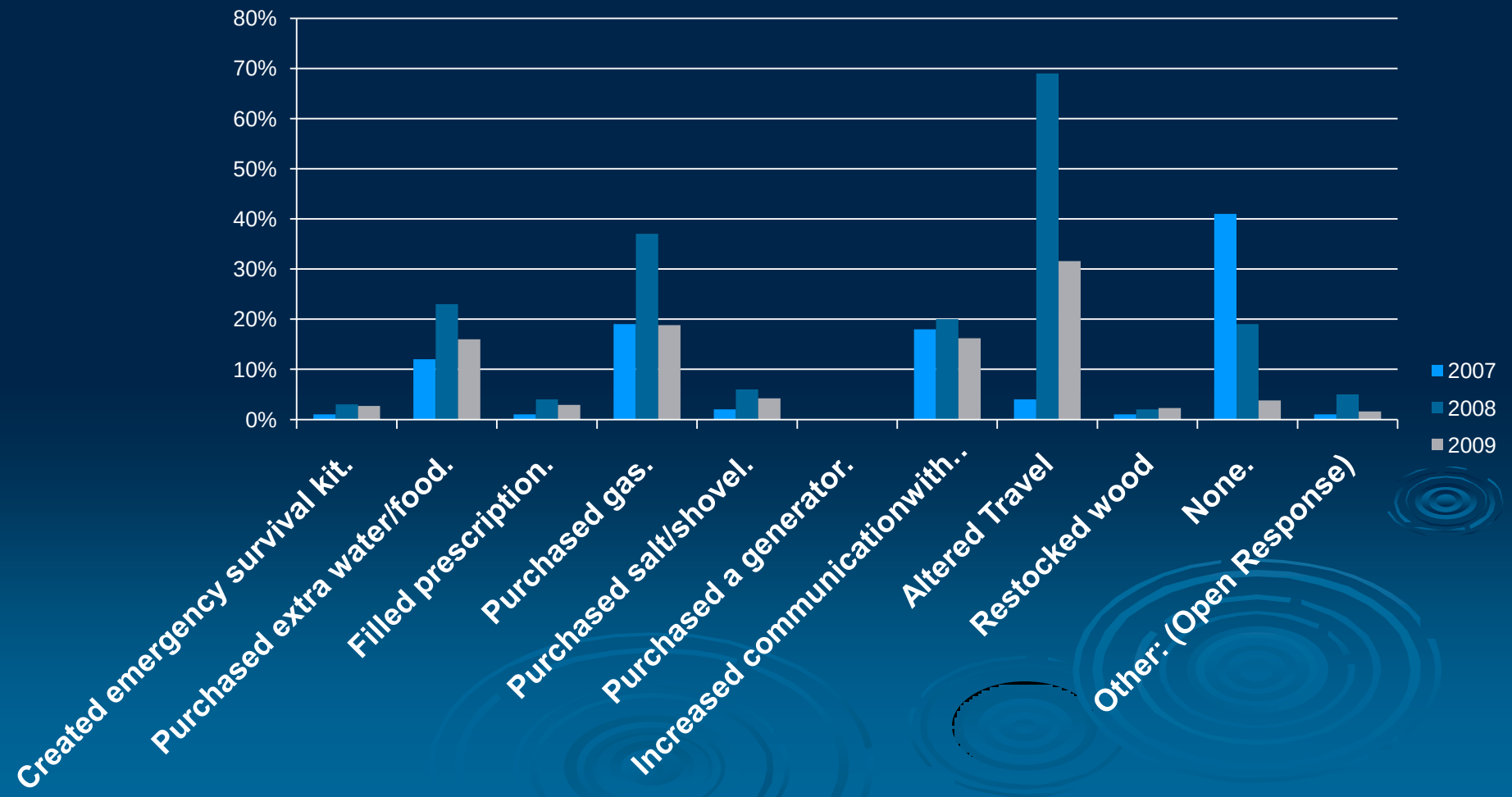
4) Based on the forecast, do you feel that this was a climatology "usual" storm?



All Responses

** Combined responses from all events**

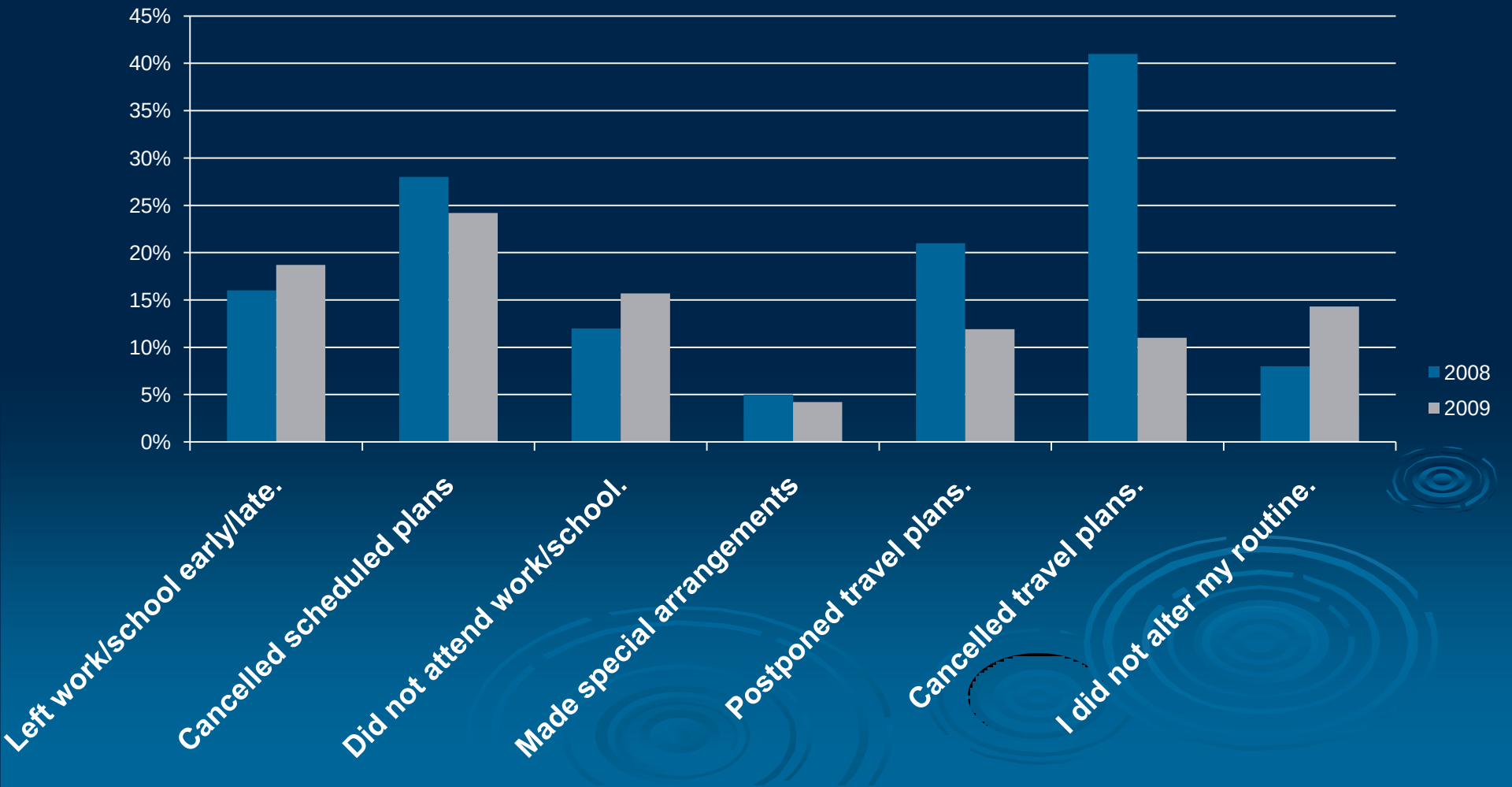
5. Based on the forecast, what special preparations did you take for this storm?



All Responses

** New 2009 Question**

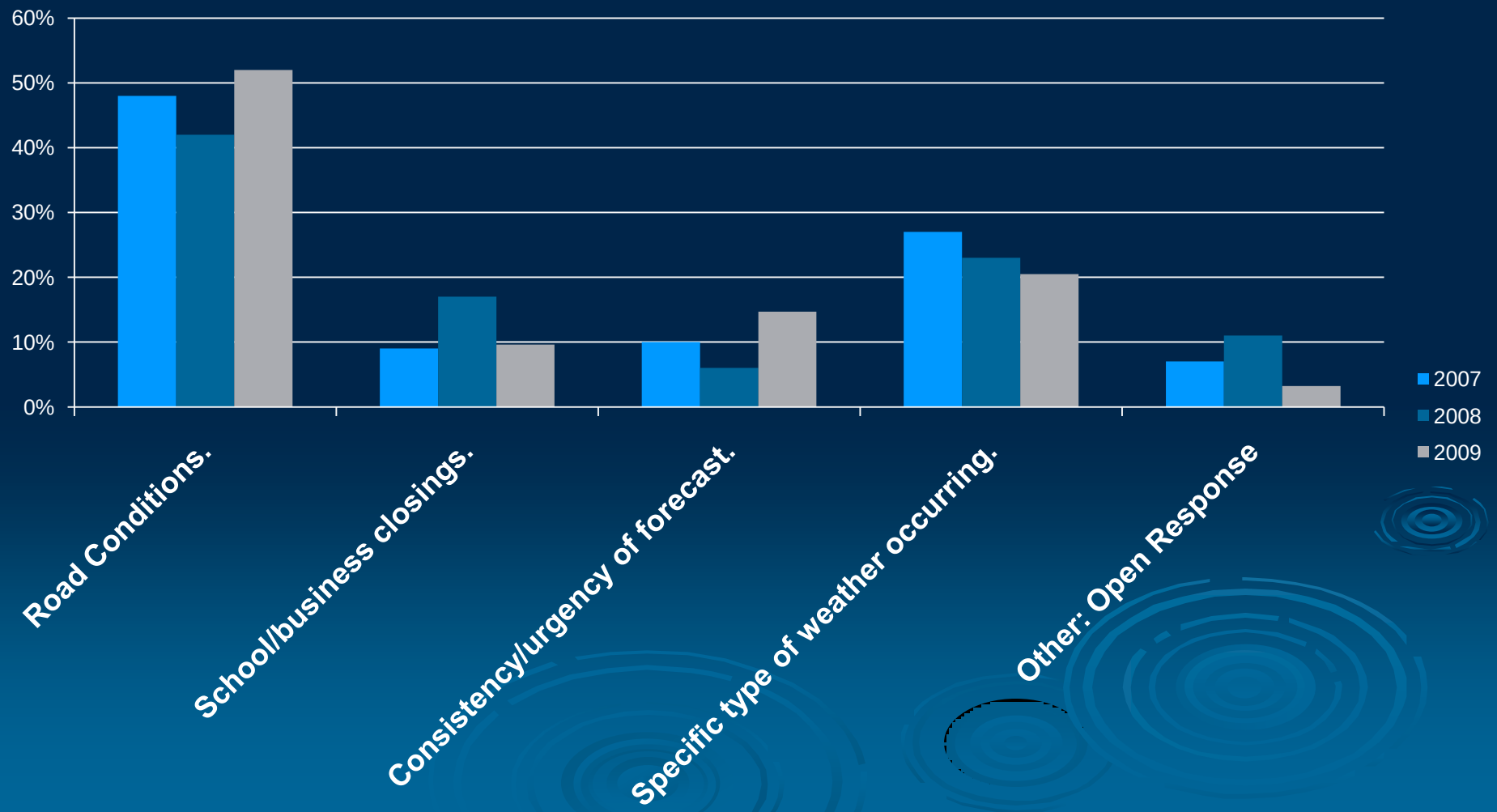
6. How did you alter your daily routine during this storm?



All Responses

** Combined responses from all events**

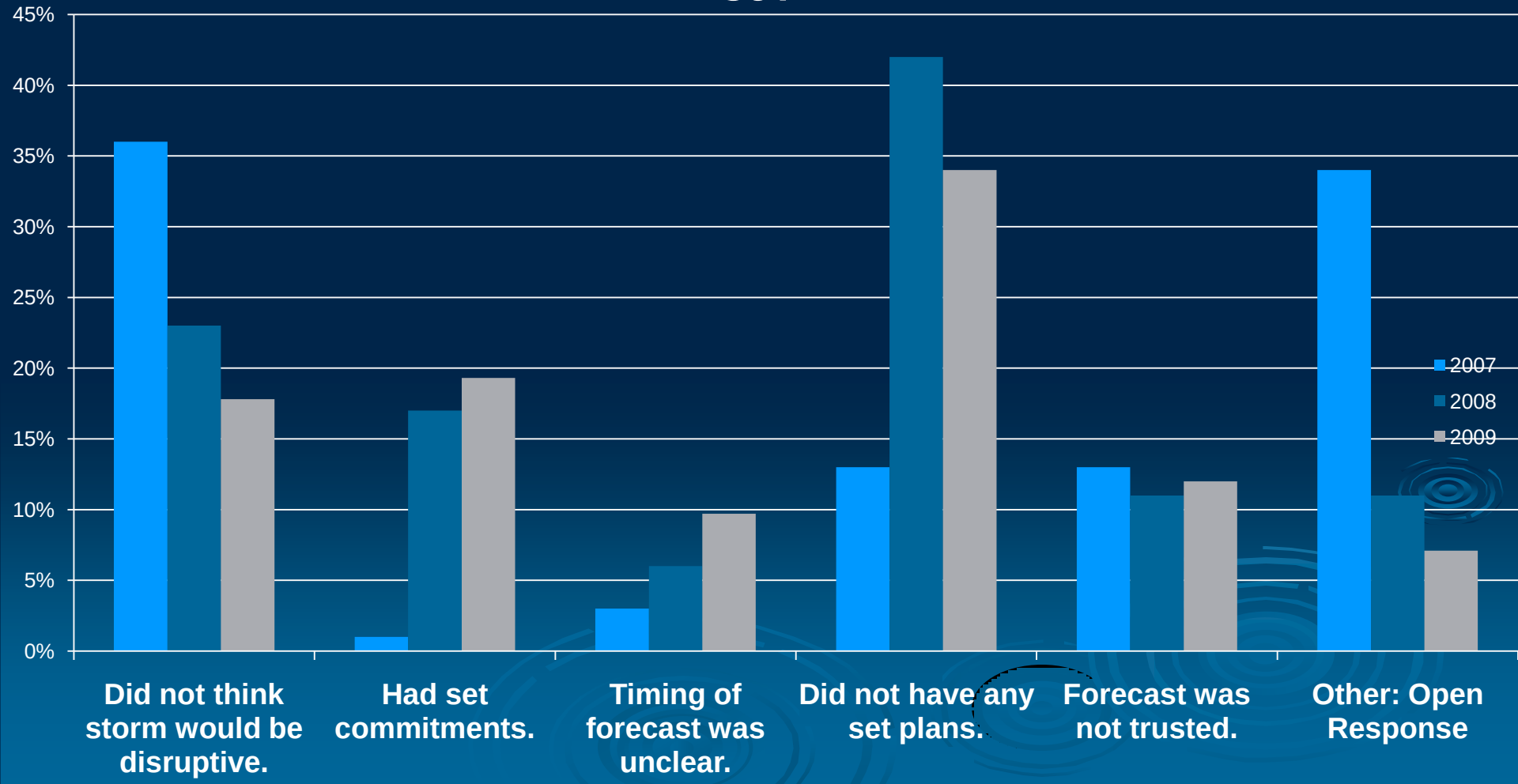
7) If you DID alter your daily routine, what specifically made you do so?



All Responses

** Combined responses from all events**

7) If you <u>DID NOT</u> alter your daily routine, what specifically made you do so?



Conclusions

- Results rather consistent and provided many interesting trends
- **People care about road conditions!**
- **Shows that people care most about what will cause personal inconveniences…not necessarily precipitation amounts.**

Conclusions Continued

- Trending forecasts and timing both communicates uncertainty….
- People pay attention to warning headline….perhaps not much else.
- As event unfolds, media becomes crucial…
- People care about non-meteorological indicators (school closings, etc.).

Conclusions Continued

- Notable differences in different areas of country and urban/rural locations.
- Different demographics also show many smaller details.
- Differences in events that were busts and surprises…adds confidence to data!
- Still widespread bias against the meteorologist!

The Future

- Graduating May 2010.
- NEED another student to take up project.

- Next year will still be active, especially with NWS Eastern Region interested.

Special Thanks

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- Tony Hansen
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- Mike Bettwy
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Thank You!

Any Questions?

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The Questions

1. **Where do you get weather information on a <u>regular basis?</u>**
2. **Where did you get your weather information <u>during the storm</u>?**
3. **Based on the forecast; what did you feel was the primary weather threat from the storm?**
4. **Based on the forecast, do you feel that this was a climatology “usual” storm?**
5. **Based on the forecast, what special preparations did you take for this storm?**

The Questions

6. **How did you alter your daily routine during this storm?**
7. **If you <u>did</u> alter your daily routine, what specifically made you do so?**
8. **If you <u>did not</u> alter your daily routine, what convinced you alterations were not necessary?**

Demographic Information:

Gender, Age, Occupation, Commute Time, Education Level, Trained Weather Spotter